Fossil Plants as Tests of Climate. By A. C. Seward, M.A., F.G.S., &c. 8vo. 151 pages. C. J. Clay & Sons: London.

This is the "Sedgwick Prize-essay" for the year 1892, and its subject has been well chosen (1) as being worthy of, and indeed requiring an earnest and comprehensive study of both recent and fossil botany by the essayist, and (2) as a subject, a broad view of which, based on trustworthy details, is a desideratum with geologists.

As is due to observers in the past, though results of value were scanty even in the early part of the present century, careful references to early works, and critical notes on the facts and opinions therein stated, are given in the "historical sketch" (pages 1–32), which, like the Essay itself, is based on Mr. Lester F. Ward's 'Sketch of Palæobotany,' in the 'Fifth Annual Report of the U.S. Geol. Survey' for 1883–84, pages 363–453 (1885), and extended to the present time.

A general knowledge of the present distribution of plant-families, and of their relation to climatal conditions, must precede the consideration of the coexistence of the ancient and extinct floras with the successive geographical conditions of bygone lands and their changing climates; Chapters II. and III., therefore, comprise pertinent remarks by trustworthy authors treating of the distribution of plants, with reference to geography and topography, height of land above the sea-level, the nature of the soil, and, lastly, low temperatures, as in Greenland, Grinnell-land, Alaska, and Russian Lapland.

In Chapters IV. and V. the influence of external conditions upon the macroscopic and microscopic structures of plants is considered, on the basis of published reports with respect to the habit and size of plants in relation to climate; the form, position, and structure of leaves; their minute structure and its relation to external conditions; water-plants; acclimatization and naturalization; and minute anatomy of fossil plants; also the annual rings in recent and fossil plants.

"By far the most interesting lessons in questions of ancient climates have been taught by fossil plants in the high northern latitudes of the Arctic regions," hence Chapter VI. comprises the notices and remarks made by various observers on (1) the Devonian and Carboniferous plant-remains of Bear Island, Spitzbergen, and Melville Island. (2) Upper Carboniferous of Siberia, Novaya Zembla, and Spitzbergen. (3) Jurassic of Spitzbergen and Melville Island (?). (4) Cretaceous of Spitzbergen and Greenland. (5) Tertiary of Spitzbergen, Iceland, Greenland, Grinnell-land, Bathurst Island, Banks' Land, Prince-Patrick Island, and Mackenzie River. (6) Quaternary of Spitzbergen.

So far as the fossil plants of the Arctic regions have been studied O. Heer considered that they give no evidence of any difference in the temperature of the Polar Regions from that of Central Europe;

and it may be taken conclusively that no direct evidence is afforded in favour of the existence of climatal zones in Carboniferous and Jurassic times.

The Tertiary Arctic plants were regarded as Miocene by Heer; but J. S. Gardner has adduced reasons to prove that they show a passage from the Cretaceous to the Miocene, and that therefore they may claim to be Eocene.

The difficulty of regarding the plants of the old Coal-measures as definite indicators of climate is carefully dwelt upon. Their several structures and relative size cannot be taken without great caution as indications of a tropical climate, nor of the presence of an excess of carbonic acid in the air; nor indeed would a hot climate suit the peat-like decomposition of marsh-plants. Certainly the coal-plants had a very wide geographical distribution, favoured by (1) the absence of the highest plant-forms, and which would have been strong opponents in the struggle for existence; (2) their propagation by spores, being thereby widely disseminated. Nevertheless, there are important differences in the plant-remains of distinct coal-fields. Thus the Carboniferous flora of North America contains a large number of species not represented in that of Europe.

In Chapter VII. the climate and vegetation of the Carboniferous Period are reviewed according to evidences derived by geologists from its plant-remains found in different parts of the world. Those of the European and North-American Coal-measures are abundantly noticed in the foregoing chapters, as they take their places under the different structural or other relationships; and now (pp. 102, &c.) that the probable existence of different climatic zones or botanical provinces in the Coal-period has to be discussed, the Carboniferous (or Permo-Carboniferous) strata and plants of India, South-Africa, and Australia are taken in order. 1. The Lower Gondwána System in India, including the Panchet, Damuda, and the Talchir series. 2. The Karoo formation in South Africa, or rather the Ecca Beds lying just below it. 3. The Wianamatta, Hawkesbury, Newcastle, and Muree beds of New-South-Wales. 4. Queensland. 5. Tasmania. These several regions and their formations are tabulated (pp. 122, 123) after Feistmantel and Waagen, to show more particularly the horizons of 1. Glossopteris, 2. Glacial phenomena, and 3. Lepidodendron. The essayist is as cautious in giving an opinion in this case as in all the other points of discussion, but seems to accept the opinion expressed by Neumayr, Blanford, and Feistmantel that the Glossopteris flora came in with the cold climate indicated by the glacial conglomerates, and, replacing the older Carboniferous types, spread gradually towards the North, probably from a Southern Continent.

The recent valuable researches by Clement Reid and others on Pleistocene plants indicative of a cold climate in Britain, as some of Pliocene age witness low mean annual temperatures for Switzerland and elsewhere at that particular period, are referred to in Chapter VIII. Further accurate research is required to approach with certainty any conclusion as to climatal conditions in the several

geological periods. Some indications have been offered in the course of the essay, as shown above. The Mesozoic floras in particular have yet to be carefully reviewed as tests of climate. Suggestive remarks on fossil Ferns and Conifers are then offered; and the Author says:—"We may expect that a closer study of the Geological floras, not only from phylogenetic and anatomical, but also from biological points of view may enable us to penetrate further into the life-conditions of those forests of which the Earth's crust affords us such numerous, though often too fragmentary, relics."

The list of works referred to in the text, occupying pages 134–146, well arranged and made serviceable with reference to the numerous footnotes, is a welcome bibliography for palæobotanists. The Essay has also a useful Index. Like other scientific works issuing from the University Press at Cambridge, this is well printed on good paper.

MISCELLANEOUS.

Comparative Researches upon the Organization of the Brain in the principal Groups of Arthropods. By M. H. Viallanes.

I have the honour of communicating to the Société de Biologie the principal results of researches which I have been conducting for several years upon the organization of the nervous system of Arthropods, and of which I have hitherto only published detached fragments, some in the 'Annales des Sciences Naturelles' and the rest in the 'Comptes Rendus de l'Académie des Sciences.'

Organization of the Brain of Insects.—In the Insects the brain is formed of three segments corresponding to the first three cephalic zonites. The first segment, or *protocerebron*, innervates the eyes; it is the seat of the visual perceptions, while the psychic centres also reside in it. The second segment, or *deutocerebron*, innervates the antennæ; it is the seat of the olfactory perceptions. The third segment, or *tritocerebron*, innervates the labrum and the initial portions of the digestive canal; in it is situated the centre of the gustatory sense.

Before entering further into detail as to the constitution of the cerebral segments, it may be mentioned that the first two are entirely præœsophageal, that is to say that the commissures which unite their symmetrical portions are situated in front of the œsophagus. In the case of the third segment the conditions are different; here all the commissural fibres pass behind the œsophagus, where they constitute the commissure known under the name of the *transverse commissure of the œsophageal ring*.

The protocerebron is composed of a pair of lateral masses termed optic ganglia and of an intermediate median mass. The constitution of the optic ganglia is most remarkable and most constant;